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ABSTRACT

To investigate the effect of outside help in executing a successful science fair project, surveys were distributed to 356 participants in the 1987 Mississippi Region V Science Fair. Of this number, 147 students were in grades 7 and 8, 136 in grades 9 and 10, and 73 in grades 11 and 12. Students listed the number of hours they spent using outside facilities such as the public or school library, high school lab or shop, parents' or friends' business or shop, medical school facilities, university facilities, or other outside resources. Students also chose between five levels of spending in estimating the direct costs of their projects. Analyses of the 18 variables showed that use of college or university resources and direct cost of the science fair project were most highly correlated with science fair placement. An analysis showed that several variables were responsible for predicting 15% of the variance. The variables were: (1) direct cost of the project; (2) use of university resources; (3) use of high school lab or other research facility; (4) use of public library; (5) use of parents' or friends' shop; (6) use of parents' or friends' business; and (7) consultation with a school science teacher. The latter three variables were negatively correlated with winning science fair projects.
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THE EFFECT OF THE USE OF OUTSIDE FACILITIES
AND RESOURCES ON SUCCESS IN SECONDARY SCHOOL SCIENCE FAIRS

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ABSTRACT

To investigate the effect of outside help in executing a successful science fair project, surveys were distributed to 356 participants in the 1987 Mississippi Region V Science Fair. Of this number, 147 students were in grades seven and eight, 136 in grades nine and ten, and 73 in grades eleven and twelve.

Students listed the number of hours they spent using outside facilities such as the public or school library, high school lab or shop, parents' or friends' business or shop, medical school facilities, university facilities, or other outside resources.

The number of hours spent consulting advisors at such facilities constituted other categories. Students also chose between five levels of spending in estimating the direct costs of their projects.

Five places and a variable number of honorable mentions were awarded in eleven divisions at the regional science fair. Of the 356 students surveyed, 69 placed in one of the top three categories; 196 did not place in any category. Analysis of the eighteen variables showed that use of college or university resources and direct cost of the science fair project were most highly correlated with science fair placement. A discriminant analysis program showed that eight factors were responsible for predicting 15% of the variance. These eight factors were direct cost of the project, use of university resources, high school lab, other research facility, public library, parents' or friends' shop, parents' or friends' business, and consultation with a school science teacher. The latter three variables were negatively correlated with winning science fair projects.

Many factors appear to remain unmeasured that go into producing a successful science fair project. However, this

study shows that students can maximize their success by using resources available at research facilities and by obtaining adequate funding for their projects.

INTRODUCTION

The alleged purpose of science fairs is to teach students how "to science," specifically, how to design and execute an experiment. In fact, science fairs become competitive experiences, often a required component of a high school course. Sixty-four percent of the high school students in the 1985 Mississippi Region I Science Fair reported that their projects were required and graded (Brown et al, 1986). The prestige and financial rewards of winning top prizes such as the Army, Navy and Westinghouse awards encourage elaborate projects which can be carried out only in research facilities (Science Talent Search, 1977). Prizewinning projects often require extensive professional aid, facilities, and money (Orlans, 1978). In fact, rules for the International Science and Engineering Fair require the approval of a supervising scientist for certain types of projects (Rules, 1986).

Although parental help is encouraged during elementary and middle-school years (Hamrick and Harty, 1983; Burtch, 1983). Paldy (1971) warned that excessive involvement by parents and others may lead to "unwholesome external pressures." McBurney (1978) emphasized that projects should teach the experimental method, not serve as ego trips for student, parent, or school personnel. While the usefulness of outside help is considered beneficial by some (Goodman, 1975), too much competitive zeal has been blamed by others (Smith, 1980) for technology-oriented, rather than science-oriented, fairs. Judges of science fairs are urged to ascertain the nature of the assistance that the

student has received and to favor student-generated and produced projects (Judging criteria, 1979). However, Brown et al (1986) found that 61% of participants in the 1985 Mississippi Region I Science Fair enlisted outside help. Therefore, the purpose of this study was to determine the extent to which the use of outside facilities and resource individuals affects the placement of science fair contestants.

METHODOLOGY

Subjects: The subjects in this study were 356 junior and senior high school students (categories 3, 4, and 5) exhibiting in the 1987 Mississippi Region V Science Fair. Winners were designated as those students placing first, second, or third in each of the eleven categories. Non-winners were defined as those students who did not place or receive an honorable mention in category judging.

Data collection instrument: Questionnaires were passed out at the Region V Science Fair asking students to give the approximate number of hours they used any of the following resources or facilities: public or school library, high school lab or shop, parents' or friends' business, shop, or farm, college or university, medical school, other research facility, or other resource. They were also asked to estimate the number of hours spent in consultation with the following advisors: science teacher, other teacher, medical personnel, college or university personnel, personnel of other research facilities, or any other advisor. In addition they were asked to estimate the costs to them of completing their project. Cost categories were 0-\$100+ in \$25 increments.

Analysis: Winners were designated as those placing in the top three of each of eleven categories. Fourth and fifth place winners and honorable mentions were dropped from the study.

Non-winners were those who did not place. Discriminant function analysis and chi-square analysis were performed on the two groups.

FINDINGS

Discriminant analysis was performed to differentiate between winning and non-winning science fair participants. When the number of hours they spent using various resources and facilities was analyzed, as shown in Table 1, a canonical correlation of .37 was derived from a Wilks' lambda of .85. This computation yielded a chi-square value of 39.57 with eight degrees of freedom, significant at the .000 level. These data indicated a significant difference between winning and non-winning projects based on the eight variables listed. Fifteen percent of the variance was attributable to these eight variables.

TABLE 1.

Discriminant analysis differentiating between winning
and non-winning science fair participants

Variables in set	Canonical correlation	Wilks' lambda	df	χ^2	p
8	.37	.85	8	39.57	.000

In Table 2 the eight variables that differentiated the two groups are listed. The discriminant coefficient indicates the degree each variable influenced the differences between winners and non-winners. A variable was allowed to enter the equation as long as it accounted for 1% of the variance between the two groups.

TABLE 2.

Results of canonical discriminant functions between
science fair winners and nonwinners

Variable	Wilks'	Discriminant	Winner		Nonwinner	
Entered	Lambda	Coefficient	$\bar{X}$	SD	$\bar{X}$	SD
University						
Resource	.936826	.62064	6.75	19.10	.81	3.10
Cost (level)	.900643	.42508	2.03	1.34	1.48	.95
H.S. Lab	.888788	.36601	1.55	4.57	.56	2.41
P/F Shop	.880255	-.29013	1.43	6.73	1.75	6.86
Other Res. Fac.	.873248	.25453	1.22	3.46	.50	1.68
Science Tch.	.867104	-.26788	2.59	3.80	2.60	5.35
Public Library	.862471	.26038	5.48	13.76	2.14	4.13
P/F Business	.858314	-.18737	1.30	3.78	2.12	8.69

The most discriminating variable in the equation was the use of college or university resources, accounting for 6% of the variance. Science fair winners indicated they spent a mean of 6.75 hours using college or university facilities while non-winners spent 0.81 hours. Direct cost of competing science fair projects was the second best predictor of placement, accounting for an additional 3% of the variance. Winners indicated that they spent between \$50-75 per project while non-winners spent between \$25 and \$50 per project. Six other factors differentiated between winners and non-winners. Larger numbers of hours spent using high school labs, other resource facilities, and the public library favored science fair winners.

Three factors produced significant negative discriminant coefficients, indicating that non-winners spent more hours using these resources or individuals. These categories were parents' or friends' business, parents' or friends' shop, and help from a secondary school teacher.

Success in classification of the subjects into the two groups by means of the eight variables can be seen in Table 3. Use of the eight variables was helpful in placing 74.34% of the "grouped" cases in their respective groups of winning or non-winning science fair participants.

TABLE 3.

Success in classifying students as winners or non-winners as determined by resource and aid variables

Group	No. of cases	Predicted group membership			
		Winners		Non-winners	
		No.	%	No.	%
Winners	69	36	52.2	33	47.8
Non-winners	196	35	17.9	161	82.1

Percent of "grouped" cases correctly classified: 74.34%

CONCLUSIONS AND IMPLICATIONS:

Eight variables significantly differentiated between science fair winners and non-winners in this project. Ten variables: use of school library, school shop, parents' or friends' farm, medical school, other research facility or non-research

resource, and consultation with medical school or university personnel, consultants at other research facilities or other non-research resources did not result in significant discriminant coefficients.

Two positive discriminant coefficients and three negative discriminant coefficients indicate that location of a student's secondary school may determine his or her potential to win.

Students spending a greater amount of time using university facilities and other research facilities had a better chance of winning. It could be that students not having access to these facilities spent more time working with the secondary school science teacher and in parents' or friends' businesses and shops. These three activities were more characteristic of non-winners than winners.

When using the results of discriminant function as a total set applied to each individual as a predictor, the information was able to correctly classify 74.34% of the participants. The set was a particularly good predictor of non-winners.

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